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National Library Service
for the Blind and
Physically Handicapped

Specification 1100:2012

Digital Talking-Book Player Applications for Mobile Devices



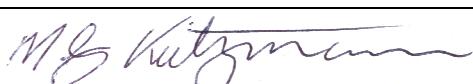
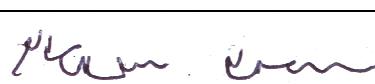
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1. Scope

This specification covers the requirements for development of digital talking-book player applications for mobile devices. The applications will download and render both audio and braille books produced for the National Library Service for the Blind and Physically Handicapped (NLS), Library of Congress.

2. Reference Documents

The following documents and publications form a part of this specification. In the event of conflict between the documents and publications referenced herein and the content of this specification, the content of this specification shall be considered a superseding requirement.

2.1 Specifications

American National Standards Institute (ANSI)

ANSI/NISO Z39.86-2002
Specifications for the Digital Talking Book

The document cited above is available from:

American National Standards Institute, Inc.
25 West 43rd Street
4th Floor
New York, NY 10036
Tel: (212) 642-4900
Fax: (212) 398-0023
and at
www.niso.org/workrooms/daisy/Z39-86-2002.html

DAISY Consortium

DAISY Protected Digital Talking-Book Specification, Version 2.0

available at:
www.daisy.org/projects/pdtb

National Library Service for the Blind and Physically Handicapped

NLS Specification 1203;2011
Construction of Digital Talking Books

NLS Specification 1205
Protected Digital Talking Book

The documents cited above are available from:

National Library Service for the Blind and Physically Handicapped
Library of Congress
1291 Taylor Street NW
Washington, DC 20542-0002
Tel: (202) 707-5100
Fax: (202) 707-0712
and at
<http://www.loc.gov/nls/specs/>

2.2 Standards

European Telecommunications Standards Institute

*Extended Adaptive Multi-rate - Wideband (AMR-WB+) codec; Transcoding functions
ETSI TS 126 290 release 6 / 3GPP TS 26.290 release 10*

The document cited above is available from:

<http://www.3gpp.org/ftp/Specs/html-info/26290.htm>

*Transparent End-to-End Packet Switched Streaming Service; 3GPP file format (3GP)
ETSI TS 126 244 release 7 / 3GPP TS 26.244 release 10*

The document cited above is available from:

<http://www.3gpp.org/ftp/Specs/html-info/26244.htm>

2.3 Definitions

API	Applications Programming Interface	
BARD	Braille and Audio Reading Download	Virtual library of digital talking-books and electronic braille files accessed via the Internet
DTB	Digital Talking Book	A collection of XML, compressed audio, and other computer files that hold the elements of a talking book under the NISO Z39.86:2002 and DAISY PDTB-2 standards
KXO	Key Exchange Object	
LC	Library of Congress	
NLS NLS/BPH	National Library Service for the Blind and Physically Handicapped	Division of the Library of Congress that exists to execute the United States laws codified in 2 USC §135a, 2 USC §135a-1, and 2 USC §135b
Regional Libraries		Cooperating group of state institutions that receive recorded and braille books from NLS and circulate them to eligible patrons
RSA	Rivest, Shamir & Adleman	An algorithm for public-key cryptography
TTS	Text to Speech	
ZIP		A single archive used to contain the files of a DTB

3. Requirements

3.1 General

The following section outlines general requirements for developing a mobile application to download and render NLS digital talking-books and braille books. Requirements specific to a particular mobile operating system will be identified in brackets (e.g. [iOS - ...])

3.1.1 Minimum system requirements

The application shall only be available to install on devices meeting the minimum operating system version. Users attempting to install the application on devices that do not meet the minimum requirements shall be notified that the device does not meet minimum requirements and should be updated for installation.

[iOS – version 4.0]

[Android – version 2.2]

3.1.2 Universal design

The application shall be designed for installation on devices meeting the minimum OS requirements. The application shall be designed so that only one version shall be required for submission to the distribution repository (App Store/Google Play). The single version of the application shall be compatible with all device types (i.e. smartphones and tablets). The application shall ensure content and controls are correctly formatted based on the screen size and the orientation of the specific device.

3.1.3 Audio books

The application shall render the audio component of Digital Talking Books (DTB) constructed to the Z39.86:2002 standard including NLS/BPH books with audio encoded in all modes of AMR-WB+ and fixed bit rate MPEG1/layer III.

The application shall decrypt and render Z39.86:2002 formatted books protected with the method proscribed in the DAISY Protected Digital Talking Book Standard (Version 2) so long as the appropriate RSA private key is available.

3.1.4 Braille books

The application shall render NLS braille files on the device using a custom font (APH shadow Braille) representing the six-dot Braille cell and on a connected refreshable Braille display. Braille files have a BRF extension, with multi-volume books being contained in a ZIP archive. The files are composed of formatted lines of ASCII characters representing all combinations of dots within the cell (see Appendix A.1). Lines are composed of up to 40 characters. Pages are composed of up to 25 lines and are separated by formfeeds. The ASCII characters representing Braille cells in these files are designed for six-dot Braille embossers and may not render correctly on eight-dot refreshable displays. A character mapping must be performed prior to display for correct rendering on eight-dot refreshable displays (see Section 3.4.1).

3.1.5 Storage

The application shall support sideloading of DTBs from a user's personal computer, downloading of books from the NLS BARD website, downloading of books from internet cloud servers, and accessing books from removable media. NLS books are supplied as ZIP archives. Users may store books in either archived or extracted form. The application shall support the transfer of both extracted and archived books for inclusion into a virtual bookshelf.

[iOS – iCloud and iTunes]

[Android – Google Drive, desktop operating system file manager]

3.1.6 Book information (Audio only)

The application shall display book specific information from the metadata provided in the book OPF file. This data will be presented in a book information view (see Section 3.2.1). The following information shall be displayed:

- Title
- Author
- Narrator
- Annotation
- Total Time

3.1.7 User guide

The application shall contain a user guide constructed as a DTB. The user guide will appear on the virtual bookshelf (see Section 3.2.1). The user guide shall contain complete instructions on how to use the application. The contents (script) of the user guide shall be subject to approval by NLS. (The User Guide will be narrated and marked up as a DTB by the NLS studio using the agreed upon script)

3.1.8 Navigation in Digital Talking-Books

The application shall support navigation in NISO Z39.86-2002 DTBs. Navigation in DTBs can be separated into two basic groups:

- Relative navigation
- Direct navigation

Relative navigation is the process of moving through navigation elements sequentially. For example, this type of navigation includes fast-forward/rewind, next/previous level, next/previous page and next/previous smallest segment.

Direct navigation is the random access of specific navigation elements. For example, this type of navigation includes “Jump to Chapter”.

3.1.9 Navigation in braille books

The application shall support navigation in NLS braille books. Navigation actions for braille books shall be as follows:

- Previous line
- Next line
- Previous page
- Next page
- Top of document (beginning of book)
- Bottom of document (end of book)
- Find/Go to Page

3.1.10 Concurrent operation during telephony

The application shall support concurrent operation for mobile devices capable of telephony. The application shall immediately suspend playback upon notification of incoming telephone calls. The application shall resume playback upon completion of telephone calls.

3.1.11 Concurrent operation during downloads

The application shall continue to operate normally when downloading new content. The application shall be capable of continuing an in-progress download in the background while playing a previously loaded book or running other applications on the device. The user shall be notified once downloading is complete. The application should present books being downloaded in the virtual bookshelf with an indication that they are not yet available. An instructive notification shall be presented to the user if they attempt to select a book in the process of being downloaded.

3.1.12 Book specific settings

The following user configurable settings shall be saved and automatically retrieved for the specific book to which they were applied.

- Tone (DTB only)
- Speed (DTB only)
- Navigation level (DTB only)
- Bookmarks

3.1.13 Bookmarks

The application shall automatically create bookmarks for the beginning and end of each book. The application shall maintain a current position mark to store the current location within the book during playback.

3.1.14 Native APIs

The application shall interact with the operating system using native APIs when possible to perform required functions (e.g. Volume control, Audio equalization)

3.1.15 Accessibility

The application shall be usable by persons with visual disabilities including complete blindness but have features for users with low vision. All controls must be operable and discoverable by touch and sound. Operating system features already available for the disabled can be used and may be enhanced where required to improve specific operations of frequent use or high importance.

3.1.16 Feedback

Feedback, prompts and status messages shall be proposed and are subject to approval by NLS.

3.1.17 Verbosity

The verbosity of the audible feedback confirmation messages shall be configurable. The configuration shall be alterable under the settings control and shall be either normal or low.

3.1.18 Gestures

Gestures for control of the applications functions shall be proposed and will be subject to approval by NLS. Gestures should follow the platforms established user interface guidelines.

3.1.19 Security

The application shall initially generate, secure and store a random unique RSA key pair (known as the Instance Key). The application shall accept and securely store decryption keys contained in Key Exchange Objects described in the DAISY Protected Digital Talking Book Standard (Version 2). See section 3.6 for details regarding security.

3.2 User interface

The application's user interface shall be designed for complete non-visual access. Text information shall be rendered in audio. The application itself shall operate regardless of whether accessibility features are enabled on the device.

The application shall have separate displays for the following major functions:

- Management of all books available on the device (Bookshelf)
- Addition of new books to the device from external sources (Get Books)
- Reading of selected book (Now Reading)
- Management of user preferences (Settings)

Controls to facilitate these functions shall be presented to the user. Specific gestures used for control and/or activation shall be recommended and will be subject to approval by NLS.

Note: All figures provided in this section are for reference only and should not be considered fixed requirements.

3.2.1 Bookshelf

Books available on the device (or in the process of being downloaded) shall be presented to the user in a list. An example of such a list is shown in Figure 2. The user shall have the ability to sort the list by title, author, book number, or date downloaded. The user shall have the ability to create, delete, and rename folders for the organization of books. The user shall have the ability to reorder user created folders. The application shall contain default folders named “Audio Books”, “Audio Magazines”, “Braille Books” and “Braille Magazines”. An example of default folders is shown in Figure 1. An example of a list of books available on the device is shown in Figure 2. The user shall have the option to begin playing or reading the selected book, to delete a selected book or to get more information about the selected book.

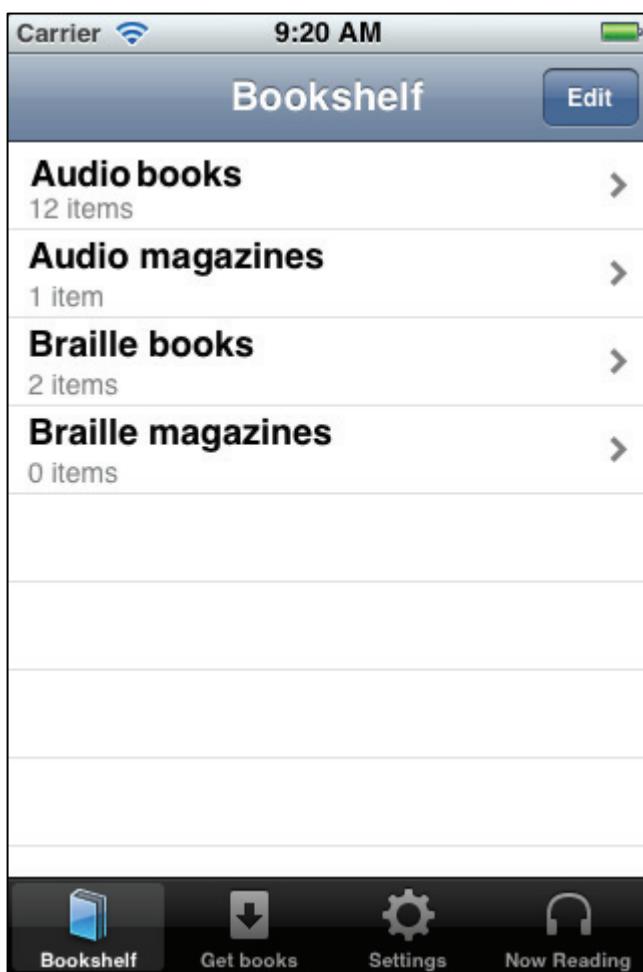


Figure 1 Example bookshelf with folders

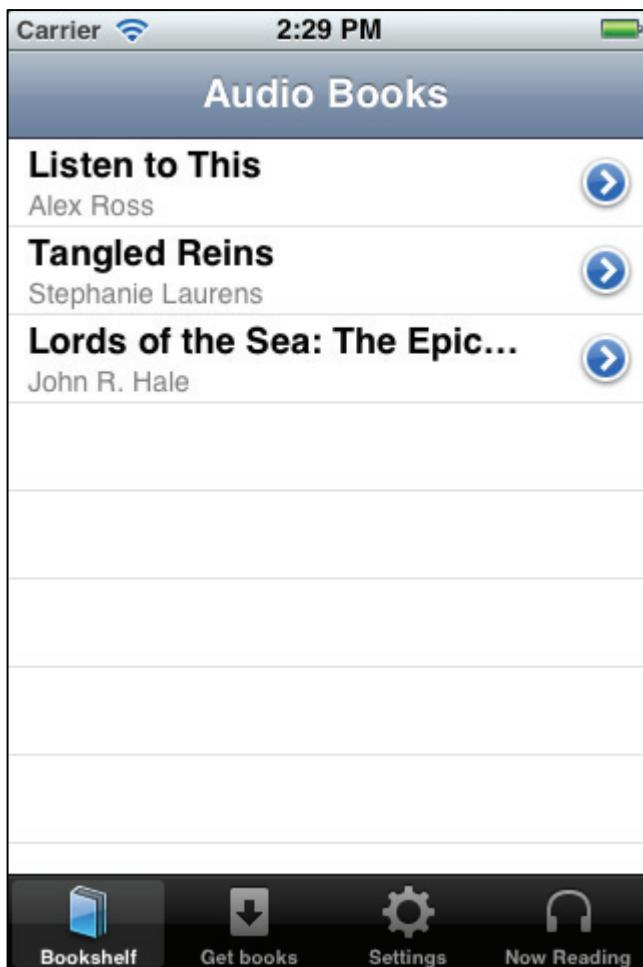


Figure 2 Example bookshelf audio books

The application shall have a control for the user to access specific information about the selected book including title, author, narrator, annotation, and total time as shown in Figure 3. This information shall be extracted from the book metadata contained in the OPF file. The user shall have the ability to select and begin playing the book from this information view. The user shall also have the ability to return to the bookshelf from this view.

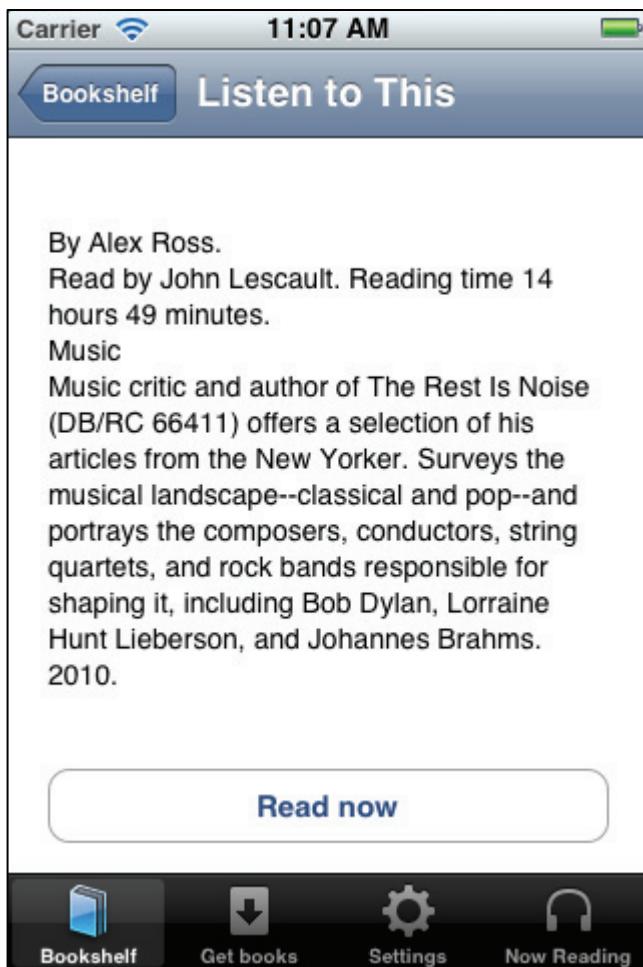


Figure 3 Example book information

3.2.2 Accessing Books

The application shall enable the user to add books to the bookshelf by downloading them from BARD or cloud storage. The application shall present the user with the following choices for downloading items

- Next Wish List item
- Browse Wish List
- Recently added books
- Recently added magazines
- Browse BARD catalog (using device default web browser)
- Cloud storage

A *possible* rendering of this screen is provided in Figure 4.

[Android – The application shall provide the ability for the user to browse removable media devices (i.e. SD cards, USB drives) and add books that have been copied to the storage device.]

The user shall be able to configure the display order of book sources. The user shall be able to move the most frequently accessed choices to the top of the list. The user shall be able to select the desired book and begin downloading. Download status in the form of percent complete for selected items shall be provided. The user shall be notified once each download is complete. The application shall support multiple simultaneous downloads.

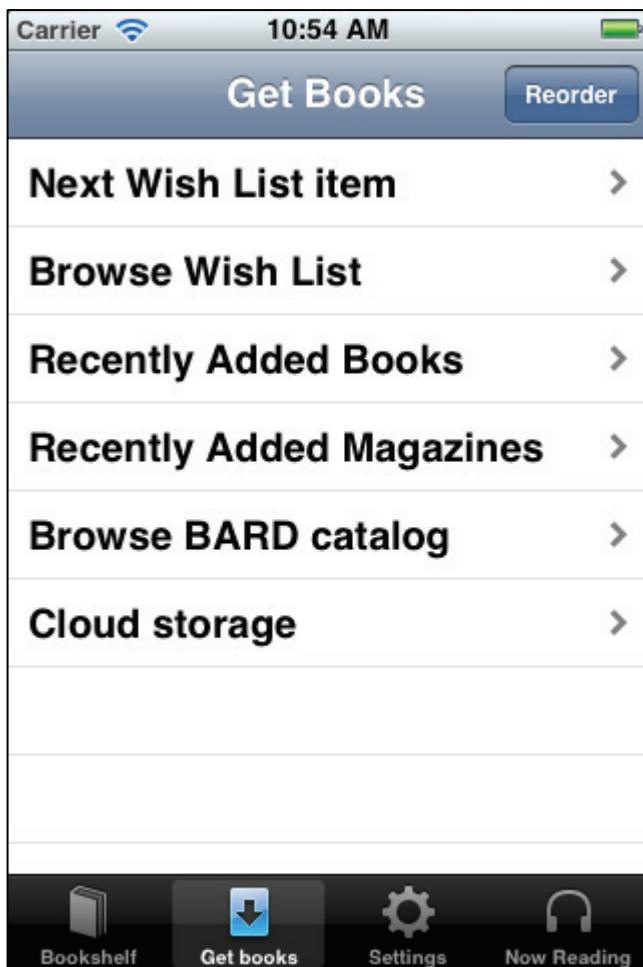


Figure 4 Example add books to device

3.2.3 Read audio book (Now Reading)

Upon startup, the application shall display the “Now Reading” view with the book that was most recently rendered. If there was no previous book rendered the application shall load the user guide. If the previous book is no longer available from the bookshelf then the application shall display the “Get Books” view and the “Now Reading” control should be grayed out.

For audio books, the “Now Reading” view shall provide the user with the following controls:

- Play/Stop
- Fast Forward
- Rewind
- Bookmark
- Next navigation point
- Previous navigation point
- Select navigation level
- Select navigation location

The application shall also provide controls for adjustment of specific book settings. These controls will be accessed less frequently and can be located on secondary view. Book specific controls are as follows:

- Speed
- Tone
- Enable/Disable Skippable elements

The “Now Reading” view shall display the book title and the current location in the book. The current location in a book shall be displayed as the text component of the current NCX element and as a progress or status bar indicating a percentage of the total playback time. Figure 5 gives an example of a *possible* screen layout for the “Now Reading” view.

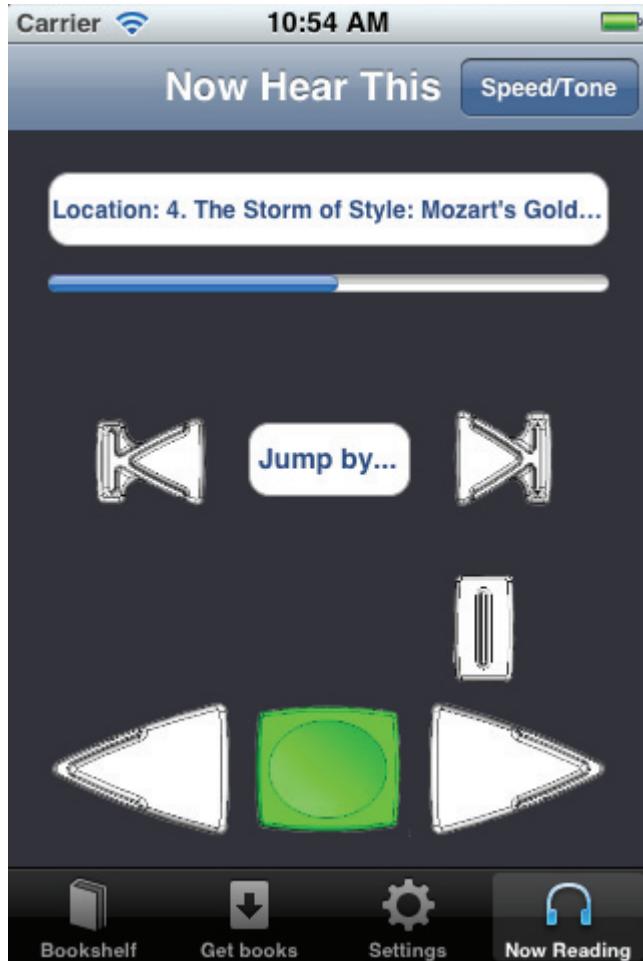


Figure 5 Example read audio books

3.2.3.1 Play/Pause control

Upon user activation of this control, the application shall start or stop playback. The control shall change appearance to indicate its current function (e.g. green to start playback and red to stop playback) Any action which causes playback to stop shall cause the application to store the current location within the book as the current position mark.

3.2.3.2 Forward/Reverse control

The application shall provide controls to move the reading position forward or backward through audio material in time increments. The behavior of this control is

described in detail in section 3.3.8. The application shall announce the amount of time moved. The application will also provide feedback, such as a tone, to the user as each navigation element is crossed.

3.2.3.3 Previous/Next control

The application shall provide controls to adjust the reading position based on the currently selected level of navigation and the navigation points defined in the NCX file (see section 3.3.9). The application announce the name of the selected element using the NCX audio labels where appropriate (when navigation occurs whilst playback is stopped) (e.g. chapter 2)

3.2.3.4 Bookmark control

The application shall provide a control to create and delete bookmarks at the current reading position (see section 3.3.10).

3.2.3.5 Navigation level control (Jump by)

The application shall provide a control to set the level of navigation. The available levels will consist of each of the nested levels of the NCX navigation control file navMap section, the smallest SMIL segments, and bookmarks. The control shall meet the following requirements:

- The application shall provide feedback when selected or if changed to the user indicating the level or type of navigation.
- The audio rendered for NCX levels shall be based on the class attribute of the NCX element selected as the navigation level.
- Prerecorded audio of standard NLS navigation classes (defined in NLS specification 1203) shall be used when they are encountered.
- If the user selects a level not present at the reading position, then the most common navigation class at that level from throughout the book shall be used

3.2.3.6 Navigation location control (random access navigation)

The application shall provide a navigation location control which shall serve as both an indicator of the current reading position within the book and as a control for moving the reading position to a specific location within the book.

The control shall meet the following requirements for display of the current location:

- The display is context sensitive to the navigation level selected. (Level 1, Bookmark, Page)
- The application shall display the text component of the current NCX element within which the current reading position is located.
- When Bookmark is selected as the navigation level the display shall contain the current Bookmark number followed by the text component of the NCX element within which the current bookmark is located.

The control shall operate as follows (except when bookmark is selected as the navigation level):

- The application shall pause playback upon activation
- The user shall be presented with a tree list providing the structure of the book defined in the NCX navMap.
- The tree list shall display all sibling NCX elements of the current location element, the parent element and its siblings and so forth up to the top level (see Figure 6)

- The tree list shall display the text component of the NCX element
- The tree list shall have a control for expanding an element to reach its children elements (if any)
- The tree list shall provide an indicator for the current level within the book
- The user shall have the ability to move the current reading position by selecting an element from the tree list.
- The application shall begin playback at the location indicated by the selected NCX element.
- The tree list shall have a control to return to the “Now Reading” view

The control shall operate as follows when bookmark is selected as the navigation level:

- The application shall pause playback upon activation
- The user shall be presented with a complete list of available bookmarks, similar to Figure 6 but with no need for expanding elements
- The list shall display the bookmark number followed by the text component of the NCX element within which the bookmark is located
- The list shall provide an indicator for the current bookmark (if appropriate)
- The user shall have the ability to move the current reading position by selecting a bookmark from the list
- The application shall begin playback at the selected bookmark
- The list shall have a control to return to the “Now Reading” view

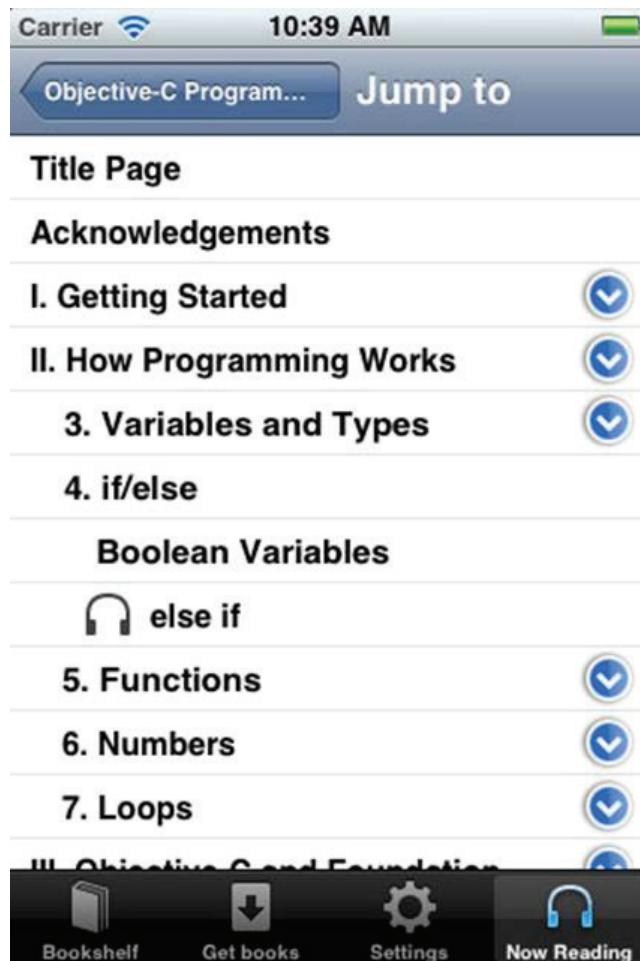


Figure 6 Example jump to NCX element

3.2.3.7 Speed

The application shall provide a control to adjust the playback speed from $\frac{1}{2}$ to 3 times normal without changing the pitch of the audio. The application shall provide an intuitive and discoverable control or method to reset the speed to normal (x1).

3.2.3.8 Tone

The application shall provide a single control to adjust the tone (amount of treble or bass mimicking a Baxandall network) of audio playback. The application shall provide an intuitive and discoverable control or method to reset the tone to normal.

3.2.3.9 Skippable elements

The application shall provide a control to enable/disable reading of elements marked as skippable in the DTB SMIL files.

3.2.3.10 Volume

The application shall rely on the native device control to adjust playback volume. Whilst the DTB is playing, even in the background, the device controls will adjust the media volume.

3.2.4 Read braille book (Now Reading)

The application shall render NLS Braille files to a view in the application and simultaneously on a connected refreshable Braille display device. The application shall use a custom font (APH shadow Braille) to display the ASCII representation of the converted Braille (see Section 3.1.4) as the Braille dot pattern. The view shall be scrollable to include the current page and shall not render the text to speech.

For Braille books, the “Now Reading” view shall provide the user with the following controls:

- Previous/Next line
- Previous/Next page
- Top/Bottom of document
- Bookmark
- Bookmark list
- Find/Go To Page

3.2.4.1 Previous/Next line

The application shall provide a control to move backward or forward by line.

3.2.4.2 Previous/Next page

The application shall provide a control to move backward or forward by page.

3.2.4.3 Top/Bottom of document

The application shall provide a control to return to the beginning and the end of the book.

3.2.4.4 Bookmark add/remove

The application shall provide a control to insert a bookmark at the current reading position. If a bookmark already exists at the current reading position then the control shall delete the existing bookmark.

3.2.4.5 Bookmark list

The application shall provide a control to display the list of bookmarks stored for the current book. The application shall provide the bookmark number and the page where the bookmark is located. The user shall be able to select the desired bookmark from the list.

3.2.4.6 Find

The application shall provide a control to search the book for a word or phrase or to go to a specific page.

3.2.5 Settings

The application shall present a screen to the user of the following:

- BARD username/password – Users BARD username and password are securely stored for authentication to BARD server. (The password shall never be displayed).
- Verbosity setting – normal or low
- Feedback – Configure TTS engine, enable haptic feedback (only on supporting devices)
- Setting for permission to download over cellular data network

- Cloud storage credentials

3.3 Audio Book Performance

3.3.1 Audio book standards

The application shall support playback and navigation of both encrypted (where the decryption key is available) and unencrypted audio books created according to ANSI/NISO Z39.86-2002 specification and (if protected) according to the DAISY PDTB 2.0 specification modified to play audio in AMR-WB+ in 3GP file format. (The NCX file of a book may contain up to 6,000 navPoints and/or 2,000 navTargets).

3.3.2 Audio codecs

The application shall support playback of audio files encoded in the following formats

- a) 3GP containing AMR-WB+
- b) MP3

3.3.3 Continuous play

The application shall provide the ability to play continuously, without user intervention, the full contents of the book up to the full length of the book or the life of the battery.

3.3.4 Parsing

The application shall incorporate a method of initially parsing the book such that playback can begin or resume within 50 milliseconds. Parsing of the book shall be performed such that device resources are managed efficiently. Once the book structure has been analyzed, the user shall then be able to start navigating through the book. An instructive message shall be rendered if the user attempts to navigate before parsing of the NCX and SMIL files have been completed.

3.3.5 Rendering

The methods chosen to parse the book and represent the structure within the application shall allow for rendering of the book within 30 milliseconds when navigating through the book based on elements supplied by the navigation control file or SMIL file. The device should be able to execute other applications if book playing is paused and sent to the background.

3.3.6 Feedback

The application shall provide feedback (e.g. audible clicks/beeps, or vibration) for confirmation that a key was pressed or another user command was accepted. Prompts, status messages, and user initiated help functions shall use recorded announcements where possible or the text-to-speech engine available to the device to provide useful feedback. The verbosity of the application's spoken confirmation messages shall be configurable.

3.3.7 Response

The application shall provide audible output within 30 milliseconds for most operations. While an audio message is playing, the pressing of any other control will stop the playing of that message immediately and activate the playing of any new message.

3.3.8 Fast Forward and Rewind

The application shall provide controls for moving forward (fast forward) and backward (rewind) through the book in discrete time increments. The application shall provide feedback to indicate the following events:

- Direction of the movement (forward or back)

- A tone indicating a navigation level 1 (or as set in the OPF file) NCX NavMap element has been crossed
- Amount of reading time moved
- Beginning or end of book is reached

The control shall operate in two modes as described below.

3.3.8.1 Fixed increment

The first control activation shall move the reading position 5 seconds. Multiple activations in this mode shall accumulate the 5 second increments and in high verbosity mode announce the total time the reading position has moved when activation ceases.

3.3.8.2 Increasing increment

If the control is held the reading position shall move in accelerating time increments through the book as follows 20 seconds, 1 minute, 5 minutes, 15 minutes, 30 minutes, 1 hour and then by additional fixed 1 hour increments until the amount of time exceeds the remaining length of the book. The application shall announce the reading time moved at each step. The time between moving the reading position to the next step shall be 3 seconds

3.3.9 Previous/Next

The application shall provide controls for moving to the previous and next book elements selected by the navigation level control. The word “element” refers to the NCX navMap/navPoint element (chapter, section, sub-section etc.), NCX navList/navTarget element (page), SMIL element, or bookmark position.

3.3.9.1 General behavior

The general behavior for the Previous/Next control is as follows:

- Control activation will interrupt playback.
- If the control is activated in Stop mode the reading position will move to the new element, provide user feedback (the navLabel audio if available or for page numbers where navLabel audio is not available, TTS of the page number) and remain in Stop mode.
- If the control is activated in Play mode the reading position will move to the point specified by the new element and resume playback.
- In the case of navigation by levels, moving the next or previous elements includes all elements within the same or higher level (e.g. moving by elements of level 2 means that all levels 1 and 2 will be navigable).

3.3.9.2 Modes of operation

The Previous/Next control shall have two modes of operation as described below.

3.3.9.2.1 Single element

Discrete activation of the control shall move the reading position by a single element based on the current setting in the navigation level control.

3.3.9.2.2 Multiple elements

Activation and hold of the control shall move the reading position by a block(s) of 5 elements (or 10 elements for pages) elements based on the current setting in the navigation level control. The application shall provide feedback to indicate the

number of elements followed by the type (e.g. 5 chapters, 10 chapters, 15 chapters, etc.). These steps will occur each 3 seconds the control is held.

3.3.9.3 NEXT behavior

The specific behavior for the NEXT control is as follows:

- A single control activation will move the reading position to the beginning of the next element (e.g. move from middle of chapter 2 to the start of chapter 3).
- If the control is activated and there is no next element the reading position shall move to the end of the book, feedback indicating the end of the book has been reached shall be provided, and Stop mode shall be entered.

3.3.9.4 Previous behavior

The specific behavior for the Previous control is as follows:

- A single control activation will move the reading position to the beginning of the current element (e.g. move from middle of chapter 2 to the start of chapter 2).
- Activations subsequent to a previous activation of the control within 5 seconds shall move the reading position to the beginning of the previous element (e.g. move from middle of chapter 4 to start of chapter 4, then to start of chapter 3).
- If the control is activated and there is no previous element the reading position shall move to the beginning of the book, feedback indicating the beginning of the book has been reached shall be provided, and Play mode shall be entered.

3.3.9.5 Undo feature

The Previous/Next controls shall provide an Undo feature. The behavior of the feature is outlined below:

- If Previous is activated within 10 seconds of Next then it will ‘undo’ the Next move. For example, if Next is activated while in chapter 2 the player will move to the start of chapter 3. If Previous is then activated within 10 seconds, the player will reposition to the point in chapter 2 where Next was activated (giving an audible signal to indicate this).
- If Next is activated within 10 seconds of Previous then it will ‘undo’ the Previous move. For example, if Previous is activated while in chapter 2 the player will move to the start of chapter 2. If Next is then activated within 10 seconds, the player will reposition to the point in chapter 2 where Previous was activated (giving an audible signal to indicate this).
- If the undo is performed in Play mode, the playback continues. If the undo is performed in Stop mode, user feedback shall be provided to indicate the current location within the book.
- In playback mode, the current position mark remains valid for 10 seconds following each activation of the Previous/Next.

3.3.10 Bookmark

The application shall create and maintain a list of bookmarks for each book. Bookmarks can be created or deleted by the user in either playback mode or stop mode by activating the bookmark control. The bookmark list shall be presented to the user as described in section 3.3.10.2.

3.3.10.1 General behavior

The general behavior for the bookmark control is as follows:

- Control activation inserts a bookmark at the current playback position
- The application provides feedback indicating a bookmark was created
- If the control is activated in playback mode then playback resumes
- The application shall be able to store and recall a minimum of 1000 bookmarks for an individual book.
- Bookmarks may be deleted when books are removed from the bookshelf if storage is required for new books. Book data should be deleted based on the order of removal (oldest deleted first).

3.3.10.2 Bookmark list

The bookmark list shall be presented upon activation of the navigation location control when the bookmark level has been selected. The following conditions apply to the book mark list:

- First mark is beginning of book marker
- Last mark is end of book marker
- User created bookmarks are located between beginning and end of book markers
- Users can scroll through the list to select desired bookmark
- Feedback provided to the user shall include a 5 second audio clip beginning at the bookmark location (with the exception of beginning and end of book markers which will announce “beginning of book” or “end of book”)
- Users can delete bookmarks from the list with the exception of beginning and end of book markers
- The reading position shall be moved to the bookmark when the bookmark is selected and playback will resume from that position if the application was in playback mode prior to bookmark selection.

3.3.10.3 Bookmark navigation

Upon selection of bookmark as the navigation level the Previous/Next control will move to the previous or next bookmarks. The following conditions apply to navigation at the bookmark level:

- The “undo” functionality will be identical to that described in Section 3.3.9.5
- The application shall provide feedback indicating bookmark as the current level of navigation
- If bookmark is selected as the navigation level during playback mode then playback shall resume following all provided feedback
- For user created bookmarks, feedback provided during navigation shall indicate the time elapsed from the beginning of the book at that position (in hours and minutes, however in the case of multiple bookmarks within the same minute, also seconds)
- Navigation in playback mode shall resume playback following the specified notification.
- When bookmark navigation occurs in stop mode, an audio clip will be played of a minimum duration of 5 seconds and continuing to the shorter of the end of the current SMIL segment or 10 seconds. The current position mark shall remain at the bookmark position.

3.3.10.4 Removing bookmarks

The application shall provide the ability to remove bookmarks in either playback or stop mode and shall provide feedback indicating a bookmark has been removed. The following conditions apply to removing of bookmarks:

- In either playback or stop mode, if the bookmark control is activated at the exact position of an existing bookmark, the bookmark is removed from that position.
- In playback mode and while bookmark is selected as the navigation level, if the bookmark control is activated within 5 seconds of an existing bookmark, that bookmark is removed.
- The user shall be able to remove a bookmark by an action within the bookmark list.

3.3.10.5 Current Position Mark

The application shall maintain a current position mark to track the current location within the book. The following conditions apply to creating and maintaining the current position flag while bookmark is selected as the navigation level:

- The first time the Previous/Next control is activated a current position mark is created at the reading position before any navigation is performed. This is true for both playback and stop mode.
- The first time a bookmark is selected from the bookmark list, a current position flag is created at the reading position before any navigation is performed. This is true for both playback mode and stop mode.
- The current position mark remains valid for 10 seconds or for 10 seconds following each activation of the Previous/Next or Bookmark.

3.4 Braille Book Performance

3.4.1 Braille book conversion

The application shall map the ASCII characters representing the six-dot Braille cell combinations to characters for correct display on eight-dot refreshable Braille displays.

The conversions shall be:

- Uppercase alphabetic characters (A-Z) to lowercase (a-z) (ASCII 65-90 to ASCII 97-122)
- @ (ASCII 64) converts to ` (ASCII 96)
- [(ASCII 91) converts to { (ASCII 123)
- \ (ASCII 92) converts to | (ASCII 124)
-] (ASCII 93) converts to } (ASCII 125)
- ^ (ASCII 94) converts to ~ (ASCII 126)
- _ (ASCII 95) converts to [del] (ASCII 127)

3.4.2 Bookmark

The application shall create and maintain a list of bookmarks. Bookmarks can be created and/or deleted by the user by activating the bookmark add/remove control. The bookmark list shall be presented to the user upon selection of the bookmark list control. The application shall be able to store and recall a minimum of 1000 bookmarks for an individual book. Bookmarks may be deleted when books are removed from the bookshelf if storage is required for new books. Book data should be deleted based on the order of removal (oldest deleted first).

3.4.2.1 Bookmark add/remove

The behavior for the bookmark add/remove control is as follows:

- Control activation inserts a bookmark at the current reading position
- If the current reading position contains a bookmark, control activation will delete the existing bookmark

- The application provides feedback indicating a bookmark was created or deleted.

3.4.2.2 Bookmark list

The behavior for the bookmark list control is as follows:

- Control activation displays the current list of bookmarks.
- First mark is the beginning of book marker
- Last mark is the end of book marker
- User created bookmarks and the current position flag are located between beginning and end of book markers
- Users can scroll through list to select desired bookmark
- Feedback provided to the user shall include the page number of the bookmark location within the book
- Users can delete bookmarks from the list with the exception of beginning and end of book markers

3.5 Settings

The application shall provide a method to store settings such that they are retained when the application is closed and restored when the application is opened. The application shall adhere to following general requirements for settings:

- For settings adjustable over a range of values (e.g. tone), feedback shall be provided to indicate the limits and the normal values of the range.
- A method shall be provided for erasing all saved settings.
- Book settings shall be saved and restored for individual books when they are selected.

3.5.1 General book settings

The following per book settings shall be defined as general book settings:

- Bookmarks
- Current position mark

3.5.2 Audio book only settings

The following per book settings apply only to audio books:

- Speed
- Tone
- Navigation level
- Enable/disable reading of skippable elements

3.5.3 Application settings

The following settings shall apply for the application:

- BARD username and password
- Enable/disable download over mobile network
- Cloud storage credentials (if required independent of platform setup)
- Verbosity (high or low)

- Enable/disable haptic feedback (device specific)
- Enable/disable Voiceover / Talkback

3.6 Installation/Authorization

The application shall be in a form that will be accepted for distribution for users in any country to install via the device's distribution repository.

[iOS – iTunes Store]

[Android – Google Play]

Every instance of the application shall require authorization of the device on which it is installed before the application can access NLS material. The application shall require the user's BARD login and password for authorization. NLS material is encrypted on a per user basis so materials transferred from BARD for use on a patron's mobile device(s) will only be accessible by that patron's authorized device(s). The application **shall not** allow reading of **any** audio books until the device is authorized.

3.6.1 NLS Application Manufacturer key

NLS shall generate an RSA key pair for the application. The NLS Application Manufacturer RSA public key shall be embedded in the application. The application will use the manufacturer RSA public key to encrypt patron and device specific information for transmission to the NLS authorization system.

3.6.2 BARD credentials

The application shall require the user to enter their BARD login id and password. The application shall store this information securely in a protected memory area. The user's BARD information will be validated for access to NLS material. The BARD information can also be recalled for an authorized device to access the BARD server for browsing, file download, and account management.

3.6.3 Device identifier

The application shall provide the unique device identifier. The identifier shall be unique to the mobile device on which the application is installed. The identifier will be part of the data submitted to NLS for device authorization. The NLS authorization system will only authorize one instance of the device identifier.

3.6.4 Instance device key

The application shall upon initialization generate a random RSA key pair for the device. The application shall submit the RSA public key to NLS for use in encrypting information sent to the application.

3.6.5 Authorization data

The application shall transmit the user's BARD credentials, the unique device identifier, and the RSA public instance device key to the NLS authorization system. The combined data shall be protected by the RSA NLS Application Manufacturer public key embedded in the application. Upon receipt the NLS server will validate the user's information and shall permit the user to access BARD and return the User key (see Section 3.6.6). Should the validation fail, the application shall provide notification to the user indicating validation failed.

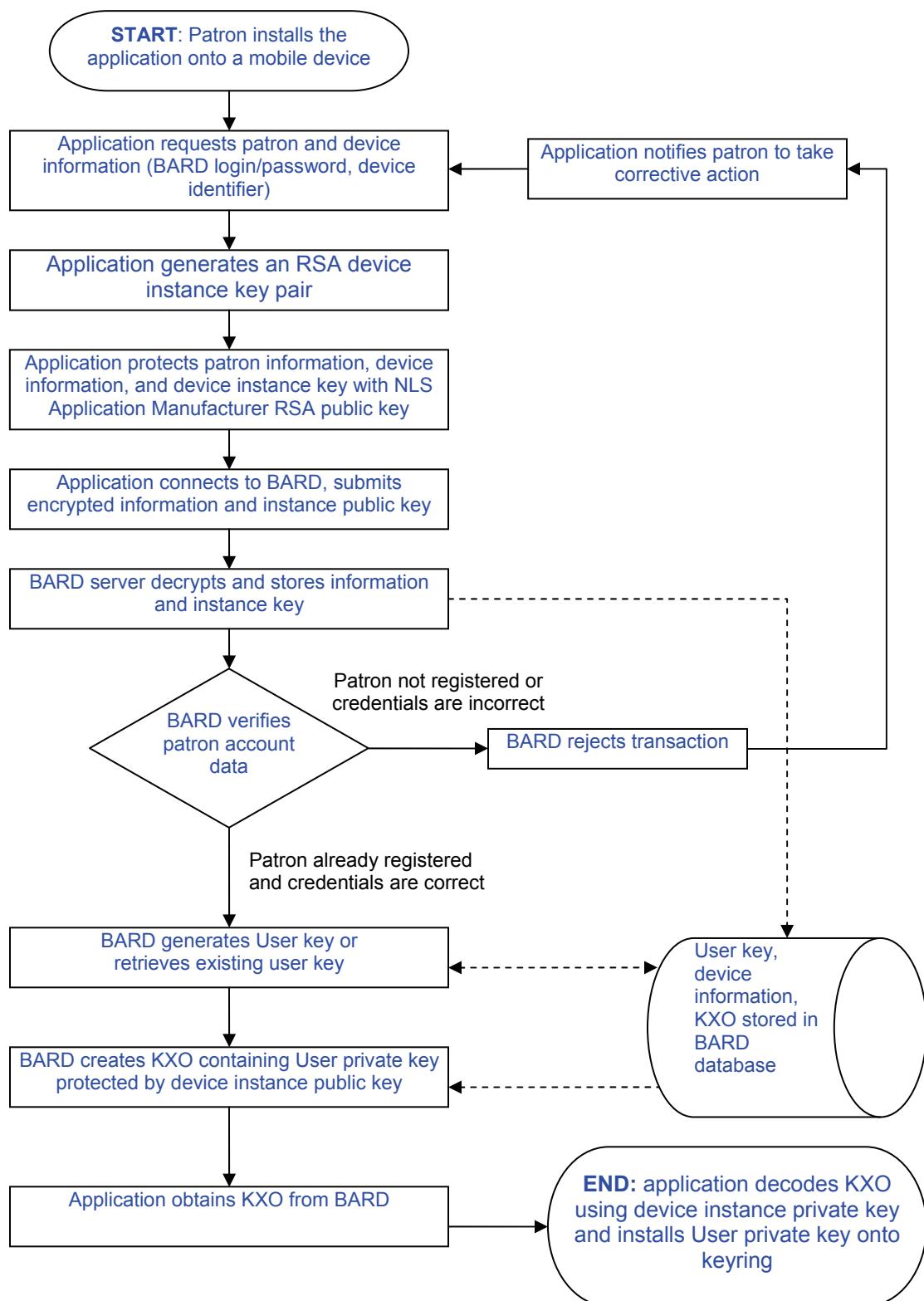
3.6.6 User key

NLS shall generate an RSA key pair to encrypt books for the validated user's mobile device. The user's private key will be protected by the public instance device key. The key will be transferred to the user's device via key exchange object (KXO). The application will accept the KXO and store the user key in protected memory. The user key will be secured within the device and will not be retrievable (except from within the application to decrypt books while playing).

3.6.7 Authorization time out

The server shall require the user to periodically login to the BARD server. If the application has not connected to BARD for a period greater than 3 months then the user's private key shall be deleted.

3.6.8 Initial Activation and Authorization



4. Quality Assurance

4.1 Test plans and procedures

The application shall be tested to ensure compliance with all requirements listed in section 3. Plans and procedures for software testing during product development shall be provided to NLS for approval. The following types of testing shall be required:

- Functional Testing
- Regression Testing
- Acceptance Testing

Documentation detailing the results from approved test procedures shall be provided to NLS for validation. NLS reserves the right to perform any testing from approved test procedures to ensure compliance with all prescribed requirements.

4.2 Test material

NLS shall provide different types of books and magazines to be used as source material during testing. All requirements must be satisfied during download, storage, and playback of each book listed.

Book Number	Title	Production Tool	Notes
63172	The Annals	LCM 4.0.0.14	Large SMIL, Skippable elements (noteRefs, notes, and prodNote), navList contains 982 NavTargets
64227	The Joy of Cooking	BWP 1.5.2.2	20 SMIL, Skippable elements (pageNums, sidebars, prodNotes), 4,655 navPoints, 1,121 navTags
73524	Cake Keeper Cakes ...	BWP 1.5.2.2	4 SMIL, Skippable elements (sidebars), Recipes marked up as SMIL segments
68777	The Bible, King James Version	LCM 4.1.06	4 SMIL, various class attributes, 1,258 navPoints
52467	The Elements of Style	CNIB Daisy 2.02 to Daisy 3 converter	Converted from Daisy 2.02, 1 SMIL per navPoint, 137 SMIL total, no class attributes
63725	I Can't Chew Cookbook...	BWP 1.3.1.111	25 SMIL, Skippable elements (pagenums, prodNote, noterefs, and notes)
52323	Blizzard: ...	N2NISO V1.0 generated NCX LpStudioPlusEdit 3.0.17 generated SMIL files	A/D conversion by Vidipax, 1 SMIL per navPoint, 12 SMIL files, Class attribute for each navPoint is H1

64738	Here's a Little Poem: ...	CJA-AMI manual text Sound Forge 6.0.e	1 SMIL, 69 par, 1 seq, XML comments at each par hinting at the name or function of the corresponding navPoint, 69 navPoints on 2 level, Class attributes Part on level 1 and Poem on level 2
F00004	Los ciegos en la historia. Tomo IV	Daisy Pipeline	Converted DAISY book
F00006	Besy	DTB Skel	Commercial audio book
08180	The Ring and the Book	Braille	Multi-volume book, poem
13639	Call If You Need Me	Braille	2 volume, large volume, short stories
-	QST Magazine, April 2012	LCM	1 SMIL, class attributes (Article, Section, Subsection), navList
-	Cooking Light Magazine, July 2012	Braille	magazine

4.3 Correction of faults by contractor

Should NLS determine that a significant fault or faults have been found in released versions, then correction of the fault or faults shall be performed under the terms of the contract without additional charge to NLS.

4.4 Inspection of contractor by NLS

The National Library Service for the Blind and Physically Handicapped, Library of Congress, reserves the right to inspect any process or tests being performed. The Library representative shall have the authority to test released versions of the application to the specified requirements at any time during the course of the contract. The National Library Service for the Blind and Physically Handicapped, Library of Congress, reserves the right to reject release candidate that has been tested and found to contain faults.

Appendix

A.1 North American ASCII Braille

North American ASCII Braille is a subset of the ASCII character set. It is used for coding contracted braille files. It consists of 64 of the printable ASCII characters (32 to 95 inclusive) to represent all possible dot combinations in six-dot braille.

ASCII Value	ASCII Character	Braille Dots	Braille
32	(space)		
33	!	2.3.4.6	⠄⠄
34	"	5	⠄⠄⠄
35	#	3.4.5.6	⠄⠄⠄⠄
36	\$	1.2.4.6	⠄⠄⠄⠄
37	%	1.4.6	⠄⠄⠄⠄
38	&	1.2.3.4.6	⠄⠄⠄⠄⠄
39	'	3	⠄⠄⠄
40	(1.2.3.5.6	⠄⠄⠄⠄⠄⠄
41)	2.3.4.5.6	⠄⠄⠄⠄⠄⠄
42	*	1.6	⠄⠄⠄⠄
43	+	3.4.6	⠄⠄⠄⠄
44	,	6	⠄⠄⠄⠄
45	-	3.6	⠄⠄⠄⠄
46	.	4.6	⠄⠄⠄⠄
47	/	3.4	⠄⠄⠄⠄
48	0	3.5.6	⠄⠄⠄⠄⠄
49	1	2	⠄⠄⠄⠄
50	2	2.3	⠄⠄⠄⠄
51	3	2.5	⠄⠄⠄⠄
52	4	2.5.6	⠄⠄⠄⠄⠄
53	5	2.6	⠄⠄⠄⠄
54	6	2.3.5	⠄⠄⠄⠄⠄
55	7	2.3.5.6	⠄⠄⠄⠄⠄⠄
56	8	2.3.6	⠄⠄⠄⠄⠄
57	9	3.5	⠄⠄⠄⠄
58	:	1.5.6	⠄⠄⠄⠄⠄
59	;	5.6	⠄⠄⠄⠄⠄
60	<	1.2.6	⠄⠄⠄⠄⠄
61	=	1.2.3.4.5.6	⠄⠄⠄⠄⠄⠄⠄
62	>	3.4.5	⠄⠄⠄⠄⠄
63	?	1.4.5.6	⠄⠄⠄⠄⠄⠄

ASCII Value	ASCII Character	Braille Dots	Braille
64	@	4	⠄⠄⠄⠄
65	A	1	⠄⠄⠄
66	B	1.2	⠄⠄⠄⠄
67	C	1.4	⠄⠄⠄⠄
68	D	1.4.5	⠄⠄⠄⠄⠄
69	E	1.5	⠄⠄⠄⠄
70	F	1.2.4	⠄⠄⠄⠄
71	G	1.2.4.5	⠄⠄⠄⠄⠄⠄
72	H	1.2.5	⠄⠄⠄⠄⠄
73	I	2.4	⠄⠄⠄⠄
74	J	2.4.5	⠄⠄⠄⠄⠄
75	K	1.3	⠄⠄⠄⠄
76	L	1.2.3	⠄⠄⠄⠄
77	M	1.3.4	⠄⠄⠄⠄⠄
78	N	1.3.4.5	⠄⠄⠄⠄⠄⠄
79	O	1.3.5	⠄⠄⠄⠄⠄
80	P	1.2.3.4	⠄⠄⠄⠄⠄⠄
81	Q	1.2.3.4.5	⠄⠄⠄⠄⠄⠄⠄
82	R	1.2.3.5	⠄⠄⠄⠄⠄⠄
83	S	2.3.4	⠄⠄⠄⠄⠄
84	T	2.3.4.5	⠄⠄⠄⠄⠄⠄
85	U	1.3.6	⠄⠄⠄⠄⠄
86	V	1.2.3.6	⠄⠄⠄⠄⠄⠄
87	W	2.4.5.6	⠄⠄⠄⠄⠄⠄⠄
88	X	1.3.4.6	⠄⠄⠄⠄⠄⠄
89	Y	1.3.4.5.6	⠄⠄⠄⠄⠄⠄⠄
90	Z	1.3.5.6	⠄⠄⠄⠄⠄⠄
91	[2.4.6	⠄⠄⠄⠄⠄
92	\	1.2.5.6	⠄⠄⠄⠄⠄⠄
93]	1.2.4.5.6	⠄⠄⠄⠄⠄⠄⠄
94	^	4.5	⠄⠄⠄⠄⠄
95	_	4.5.6	⠄⠄⠄⠄⠄⠄⠄

